

## Statement of interest

### US GEOTRACES GP17 Planning Workshop

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I am interested in participating in both GP17 cruises to investigate the following objectives:

1. Characterize end-member isotopic composition of preformed nutrients in SAMW
2. Trace isotopic evolution of nutrients in mode waters as they spread equatorward
3. Test relationship between productivity and barite precipitation across frontal zones
4. Refine estimates of particle provenance in the deep South Pacific
5. Identify telluric sources (and their significance) close to the Antarctic margin

I propose to explore each of these objectives through the lens of marine (Ba) barium cycling. Accordingly, I propose to dissolve and particulate barium concentrations ( $[Ba]$ ) and stable isotopic compositions ( $\delta^{138}Ba$ ) along both GP17 sections.

Each of the five aforementioned objectives advances the scientific goals of GEOTRACES. Regarding paleo-proxies, sedimentary Ba abundances are widely used as a proxy of dissolved nutrient distributions and carbon export productivity. Since the Southern Ocean plays an important role in governing low-latitude nutrient distributions, it is imperative to constrain both the end-member Ba-isotopic compositions of the relevant water masses (i.e., SAMW, AAIW; objective 1.) as well as their latitudinal evolution (objective 2.). Likewise, the Southern Ocean is unique in that surface waters may be supersaturated with respect to barite—the major vector of particulate Ba in seawater. This expedition offers an opportunity to test the relative importance of ambient supersaturation versus export productivity in setting the quantity of barite precipitated during remineralization (objective 3.).

In terms of internal cycling, it has long been known that the ratio of radium-226:Ba in sinking particles decreases with depth. This decrease could reflect: long-range lateral transport of particles from the continental margin, formation/re-equilibration of particles with ambient deep seawater, or differential settling. These models can be discriminated based on paired measurements of particulate Ba and Ra isotopes, which will be particularly powerful if conducted across regions of varying productivity (objective 4.)

Lastly, concerning ocean boundaries, a number of Antarctic meltwater streams have been shown to contain high concentrations of dissolved Ba. The importance of these streams to regional Ba budgets is poorly known, and could locally decouple Ba from other nutrients (objective 5.) Analogous modifications caused by seafloor barite dissolution may occur to deep waters, as has been documented in the Weddell Sea.